07-31-00

A

PATENT APPLICATION TRANSMITTAL LETTER
(Large Entity)

Docket No. MEW1855/055

TO THE ASSISTANT COMMISSIONER FOR PATENTS

JC864 U.S. PTO 09/627841 07/28/00

JC880 U.S. PTO 07/28/00

Transmitted herewith for filing under 35 U.S.C. 111 and 37 C.F.R. 1.53 is the patent application of:

Huiling Zhu and Jakob Maya

For: **Thallium Free - Metal Halide Lamp with Magnesium Halide Filling For Improved Dimming Properties**

Enclosed are:

- [x] Certificate of Mailing with Express Mail Mailing Label No. **EJ185789553US**
- [x] **4** sheets of drawings.
- [ ] A certified copy of a application.
- [x] Declaration [x] Signed. [ ] Unsigned.
- [x] Power of Attorney
- [ ] Information Disclosure Statement
- [ ] Preliminary Amendment
- [x] Other: **Assignment**

CLAIMS AS FILED

For	#Filed	#Allowed	#Extra		Rate	Fee
Total Claims	8	- 20 =	0	x	$18.00	$0.00
Indep. Claims	3	- 3 =	0	x	$78.00	$0.00
Multiple Dependent Claims (check if applicable) [ ]						$0.00
					BASIC FEE	$690.00
					TOTAL FILING FEE	$690.00

- [x] A check in the amount of **$730.00** to cover the filing fee is enclosed.
- [x] The Commissioner is hereby authorized to charge and credit Deposit Account No. **13-2551** as described below. A duplicate copy of this sheet is enclosed.
  - [ ] Charge the amount of as filing fee.
  - [x] Credit any overpayment.
  - [x] Charge any additional filing fees required under 37 C.F.R. 1.16 and 1.17.
  - [ ] Charge the issue fee set in 37 C.F.R. 1.18 at the mailing of the Notice of Allowance, pursuant to 37 C.F.R. 1.311(b).

Dated:

Signature

Owen J. Meegan, Reg. No.., 19,643
24 North Street
Salem, MA 01970

(978) 741-4135

cc:

MEW1855/055

Thallium Free - Metal Halide Lamp with Magnesium Halide Filling For Improved Dimming Properties

TECHNICAL FIELD

This invention relates to high intensity discharge lamps and more particularly to high intensity discharge metal halide lamps. Still more particularly it relates to a metal halide filling for ceramic metal halide lamps. Ceramic metal halide lamps usually contain TlI and NaI in their filling. However, other known metal halide materials such as DyI_3, HoI_3, and TmI_3 are frequently used.

BACKGROUND OF THE INVENTION

This invention relates generally to high intensity discharge (HID) lamps and, more particularly, to metal halide lamps with ceramic discharge vessels having superior dimming characteristics. Low wattage metal halide lamps with their high efficacy have become widely used for interior lighting. Until now, almost all metal halide lamps were used for general lighting and have been operated at rated power. Due to the ever-increasing interest in energy conserving lighting systems, some dimmable metal halide ballast systems are available on the market for metal halide lamps. Working under dimmed conditions (usually dimmed to as low as 50% of rated power), the performance of the regular metal halide lamps on the market deteriorate dramatically. Typically the color temperature (CCT) increases significantly, while the color-rendering index (CRI) decreases. And the lamp hue will deteriorate from white to greenish or pinkish depending on the lamp's chemistry. Furthermore the efficacy of the lamp usually decreases significantly.

Under dimming conditions, the light emitted by commercially available metal halide lamps will have very strong green hue, which can be very objectionable for many indoor

applications. The strong green hue in the light of dimmed ceramic metal halide lamp is due to the radiation of Tl green lines (535.0 nm). Under dimming conditions, the discharge tube wall temperatures as well as its cold-spot temperature is much lower compared to the temperatures at rated power. At the lower cold-spot temperatures under dimming conditions, the ratio of partial pressure of TlI in the discharge tube is much higher compared to the partial pressures of other metal halides. Under dimming conditions, the relatively higher TlI partial pressure emits relatively stronger green Tl radiation at 535.0 nm. Since the Tl radiation at 535.0 nm is very close to the peak of the human eye sensitivity curve, higher lumen efficacy is achieved at rated power with TlI as one of the filling components in almost all commercial ceramic metal halide lamps.

With the present invention, superior lamp performance under dimming conditions with ceramic discharge vessel was achieved in nitrogen filled outer jackets at relatively high pressure between about 350 and 600 mmHg by a new chemical fill of the ceramic discharge tubes. In the newly invented lamps, MgI_2 is used in the discharge tubes to replace the TlI in the fill composition of ceramic metal halide lamps. MgI_2 is used to replace the TlI as one of the fill components because Mg has both green radiation for higher efficacy and has a similar vapor pressure variation with temperature as that of the rare earth iodides in the discharge tube dosing.

Due to the similar vapor pressure variation with temperatures, MgI_2 partial pressure will drop under dimming conditions proportionally to that of the other rare-earth halides. This leads to a white lamp under dimming rather tan the greenish hue of the lamps with TlI.

Also, the relatively higher vapor pressure of MgI_2 at rated power results in relatively strong green radiation at 518 nm. Since the Mg radiation at 518.0 nm is very close to the peak of the human eye sensitivity curve, higher lumen

efficacy is achieved at rated power with MgI_2 as one of the filling components. (Under some circumstances $MgBr^2$ could be substituted for TlI).

Therefore an objective of the present invention is to provide a ceramic metal halide lamp that when dimmed to about 50% power retains substantially its white hue.

Another objective of the present invention is to provide a ceramic metal halide lamp that when dimmed to about 50% power retains the CCT (correlated color temperature) substantially as in rated power.

Yet another objective of the present invention is to provide a ceramic metal halide discharge tube fill formulation that at rated power gives substantially similar performance (including efficacy, CRI, CCT and Duv) as the currently available products on the market.

Another objective of the present invention is to provide a ceramic metal halide lamp whose performance does not deteriorate under dimming, and whose outer jacket is filled with a gas at high pressure so that arcing is avoided at the end of life or if the outer jacket leaks during the lamp life.

Still another objective of the present invention is to provide a ceramic metal halide lamp that when dimmed to about 50% power its color-rendering index remains above 70.

DESCRIPTION OF RELATED PRIOR ART

Disadvantages of existing metal halide discharge lamps:

1. Existing metal halide lamps are optimized for a rated wattage without consideration of dimming performance.
2. When lamp power is reduced to about 50% of rated value the correlated color temperature increases dramatically often more than 1000°K. This change is not acceptable for most indoor applications.

3. When lamp power is reduced to about 50% of rated value the color rendering index decreases significantly.

4. When lamp power is reduced to about 50% of rated wattage the light radiated by the regular metal halide lamp has a color point, which is far away from the black body line, leading to a nonwhite hue.

There is no known publication on the filling materials of metal halide lamps with the purpose of improving dimming performance of metal halide lamps.

One patent application (application number 09/074,623 filed May 7, 1998 by Zhu et. al. by the same assignee) was filed on an invention of a new metal halide lamp which has significantly better lamp performance under dimming conditions. In that patent application, a lamp has a discharge tube burning in vacuum outer jacket to reduce convection heat loss from the cold-spot of the discharge tube, and a metal heat shield is used on the discharge tube to reduce radiation heat loss from the cold-spot during dimming. The invention shows very good dimming performance due to the fact that the thermal emissivity of the metal shield is much lower than that of a ceramic surface. Also the emissivity of the metal goes down as the temperature drops thereby keeping the cold-spot and vapor pressure of the salts substantially constant. A disadvantage of the invention is that widely used high voltage starting pulses on low wattage metal halide lamps in conjunction with a vacuum jacket may make the lamp susceptible to arcing when discharge tube leaks or slow outer jacket leaks exist.

U.S. Pat. No. 5,698,948 discloses a lamp that contains halides of Mg, Tl and one or several of the elements from the group formed by Sc, Y and Ln. The lamp filling also contains Mg to improve lumen maintenance. The lamp has a disadvantage of strong green hue when dimmed to lower than the rated power,

due to the relatively higher vapor pressure of TlI under dimming conditions.

Lamps according to the present invention do not contain TlI in their chemical fill, so there is no hue change due to higher TlI vapor pressure under dimming conditions.

Lamps according to the present invention contain MgI_2 as one of the main filling materials. The MgI_2 is in a molar quantity between about 5 and 50% of the total molar quantity of the total halides. It replaces TlI for green light emission and to reach the same lumen efficacy as the commercial lamps containing Tl fills. The lamp, according U.S. Pat. No. 5,698,948, contains MgI_2 as an addition to the filling ingredients just to improve lumen maintenance during lamp life. Through the addition of Mg to the lamp fill, according to the patent, one can influence the balance of one or several chemical reaction between Sc, Y and Ln with spinel ($MgAl_2O_4$) to such an extent that this balance is already achieved shortly after the beginning of lamp life, after which a further removal of the ingredients Sc, Y and Ln does not take place. Since the Mg addition is for reducing chemical reaction between the filling ingredients and the wall, the quantity of Mg fill is based on the surface area of the inner wall of the discharge vessel.

Since MgI_2 fill in the present invention is for light emission and for better lamp performance under dimming conditions, the optimization of the quantities of MgI_2 fill are based on the lamp performance under rated power as well as reduced power conditions, rather than the surface area of the discharge vessel.

DESCRIPTION OF DRAWINGS

FIG. 1 is an elevation view, partially in cross section, of a ceramic metal halide lamp.

FIG. 2 is an expanded cross-sectional view showing a configuration of a discharge tube in a first embodiment of the present invention.

FIG. 3 is a curve showing the color-rendering index (CRI) of a 100-hour photometry measurement of the lamps according to embodiment I and of a prior-art lamp, available on the market.

FIG. 4 is a curve showing the lamp efficacy in lumen per watt (LPW) of a 100-hour photometry measurement of the lamps according to embodiment I and of a prior art lamp, available on the market.

FIG. 5 gives the correlated color temperature (CCT) of a 100-hour photometry measurement of the lamps according to embodiment I and of a prior-art lamp, available on the market.

FIG. 6 gives the D_{uv} of a 100-hour photometry measurement of the lamps according to embodiment I and of a prior-art lamp, available on the market.

SUMMARY OF THE INVENTION

It is an object of the invention to provide a metal halide lamp in which a superior color performance is achieved under dimming conditions.

According to the invention, the ionizable filling of the lamp also comprises MgI_2 in a molar quantity that lies between 10 and 50% of the total molar quantity of the total halides.

The lamp according to the invention has the advantage that the correlated color temperature of the lamps are hardly changed during a dimming operation, and the luminous efficacy of the lamp is not adversely affected by the new filling at rated power.

Elimination of TlI from the chemical filling has the advantage that the light radiated by the lamp has a color point which lies close to the black body line under both rated power and reduced power all the way to 50%.

The lamp of the present invention has significant advantages over lamps of the prior art during dimming per-

formance. In the earlier patent application, (Zhu et. al., Application No. 09/074,633), a lamp must have an discharge tube burning in vacuum outer jacket to reduce convection heat loss from the cold-spot of the discharge tube, and a metal heat shield is used on the discharge tube to reduce radiation heat loss from the cold-spot during dimming. Since high voltage starting pulses are general used on low wattage metal halide lamps to start the lamps. A lamp with vacuum jacket may make the lamp susceptible to arcing when the discharge tube leaks or a slow outer jacket leak exist. Also the use of the refractory metal heat shield may introduce higher lamp manufacturing cost.

With the lamp of the present invention, the ceramic metal halide lamps with superior dimming characteristics function in a nitrogen filled outer jacket which make the lamps much less susceptible to catastrophic failure during their life.

DESCRIPTION OF PREFERRED EMBODIMENTS

Referring to FIG. 1, the lamp 10 of the present invention includes a bulbous envelope 11 having a conventional base 12 fitted with a standard glass flare 16. Lead-in wires 14 and 15 extend from the base 12 through the flare 16 to the interior of the envelope 11, as is conventional. A harness formed of a bent wire construction 15, 15a is disposed within the envelope 11. The harness is anchored within the envelope on dimple 24. The harness 15, 15a and a conducting wire 14a support a discharge tube 20. The conducting wire 14a is welded onto the lead-in wire 14. A pair of straps 22a, 22b which are attached to harness 15a hold a shroud 23 which surrounds the discharge tube 20. A conventional getter 9 is attached to the harness 15a. Wires 30a, 30b supporting electrodes (not shown) are respectively attached to the harness 15a and the conducting wire 14a to provide power to the lamp and also provide support. Wires 30a, 30b are

disposed within and hermetically sealed to a pair of narrow tubes 21a, 21b.

FIG. 2 is an expanded cross-sectional view showing a configuration of a discharge tube. In FIG.2, the discharge tube 20 comprises the substantially cylindrical main tube 25, and first and second disks 28a and 28b disposed at openings of the both ends of the main tube 25, respectively. The main tube 25 and first and second disks 28a and 28b are made of the translucent ceramic material in which alumina is a main ingredient. The first and second disks 28a and 28b are integrated and fixed to the main tube 25 by a shrinkage fitting through a sintering process, so that the main tube 25 is sealed airtight.

One end of the cylindrical narrow tube 21a is integrated with the first disk 28a by the shrinkage fitting. In a similar manner, one end of the cylindrical narrow tube 21b is integrated with the second disk 28b by the shrinkage fitting. A conductive sealing member 26a, a first lead-in wire 31a and first main electrode shaft 29a are integrated and inserted in the cylindrical narrow tube 21a. Specifically, one end of the first lead-in wire 31a is connected with one end of the sealing member 26a by a welding, and other end of the first lead-in wire 31a is connected with one end of the first main electrode shaft 29a by the welding. Then, the sealing member 26a is fixed to the inner surface of the cylindrical narrow tube 21a by a frit 27a in a manner that the cylindrical narrow tube 21a is sealed airtight. When the sealing member 26a, the first lead-in wire 31a and first main electrode shaft 29a are disposed in the cylindrical narrow tube 21a, the other end part of the sealing member 26a is led outside the cylindrical narrow tube 21a, and serves as the outer lead-in wire 30a.

Furthermore, an electrode coil 32a is integrated and mounted to the tip portion of the other end of the first main electrode shaft 29a by the welding, so the first main electrode 33a is configured by the first main electrode shaft

29a and the electrode coil 32a. The first lead-in wire 31a serves as a lead-in part of disposing the first main electrode 33a at a predetermined position in the main tube 25. The sealing member 26a is formed by a metal wire of niobium. For example, diameter of the sealing member 26a is 0.9 mm, and diameter of the first main electrode shaft 29a is 0.5 mm.

Similarly, in FIG. 2, a conductive sealing member 26b, a first lead-in wire 31b and first main electrode shaft 29b are integrated and inserted in the cylindrical narrow tube 21b. Specifically, one end of the first lead-in wire 31b is connected with one end of the sealing member 26b by a welding, and other end of the first lead-in wire 31b is connected with one end of the first main electrode shaft 29b by the welding. Then, the sealing member 26b is fixed to the inner surface of the cylindrical narrow tube 21b by a frit 27b in a manner that the cylindrical narrow tube 21b is sealed airtight. When the sealing member 26b, the first lead-in wire 31b and first main electrode shaft 29b are disposed in the cylindrical narrow tube 21b, the other end part of the sealing member 26b is led outside the cylindrical narrow tube 21b, and serves as the outer lead-in wire 30b.

Furthermore, an electrode coil 32b is integrated and mounted to the tip portion of the other end of the first main electrode shaft 29b by the welding, so the first main electrode 33b is configured by the first main electrode shaft 29b and the electrode coil 32b. The first lead-in wire 31b serves as a lead-in part of disposing the first main electrode 33b at a predetermined position in the main tube 25. The sealing member 26b is formed by a metal wire of niobium. For example, the diameter of the sealing member 26b is 0.9 mm, and the diameter of the first main electrode shaft 29b is 0.5 mm.

In a practical realization of a lamp according to the invention, the discharge vessel is made of polycrystalline alumina. The main electrode shafts and electrode coils are made of tungsten. The lead-in wires of the electrodes are

molybdenum. The conductive sealing members of the electrodes are niobium. The rated power of the lamp is 150W. The filling of the discharge vessel was 10.5 mg Hg and 7.6 mg of the metal halides NaI, HoI_3, TmI_3 and MgI_2 in a molar ratio 42:6:29:23. The total molar quantity of halides of Na, Dy, Ho and Tm is between about 50 and 95%. In addition, the filling comprises Ar or Xe with a filling pressure of 160 mbar as an ignition gas.

FIGS. 3 to 6 show the comparison results of lamps with present invention and a commercial ceramic metal halide lamp. The lamps were operated with a reference ballast and measured in a two meter integrating sphere under IES reference conditions. The data was acquired with a CCD-based computerized data acquisition system. All data presented in FIGS. 3 to 6 were obtained with the operating position of the lamp being vertical base up. The experiments, for which the data is presented in FIGS. 3 to 6, were conducted using 150W ceramic metal halide discharge tube.

During operation of the lamps according to the present invention, and when comparing them to standard lamps, we found the standard lamps turned greenish on dimming and deviated substantially from the black body locus upon dimming to about 50%. When lamps with chemical fills from this invention were dimmed to about 50%, they still remained substantially on the black body locus, had no greenish hue, and generally looked white. Such color was satisfactory to the eye and it was substantially impossible to discern any color or hue change under dimmed conditions.

FIG.3 shows the changes of color rendering index (CRI) when lamps are dimmed. It can be seen that the CRI of the lamp according to the invention changed less than the standard lamp when the lamp was dimmed to 50% of its rated power.

FIG.4 shows the changes of lamp efficacy-lumen per watt (LPW) when lamps are dimmed. It can be seen that the LPW of

the lamp according to the invention and the standard lamp changes in a very similar fashion when dimmed to 50% power.

FIG. 5 shows the changes of correlated color temperature (CCT) when lamps are dimmed. It can be seen that the CCT of the lamp according to the invention did not have significant change when the lamp was dimmed to 50% of its rated power. With the prior art lamp, the CCT change was significant when the lamp was dimmed to 50% of its rated power.

FIG.6 shows the changes of lamp D_{uv} when lamps are dimmed. As is well known D_{uv} is a measure of the deviation from the blackbody. It can be seen that the D_{uv} of the lamp according to the invention did not have significant change when the lamp was dimmed to 50% of its rated power. With the prior art lamp, the D_{uv} change was significant when the lamp was dimmed to 50% of its rated power.

Therefore one can conclude that the lamps according to our formulation, containing MgI_2 instead of TlI, perform comparably to the standard lamps at rated power. This performance includes efficacy, CCT, CRI and D_{uv} (which is a measure of how close the light source is to the blackbody curve). Furthermore, when standard lamps are dimmed to 50% power level their performance deteriorates substantially. What is most disturbing, in this deterioration, from the end user's point of view is the change in CCT and hue which is given by D_{uv}. As shown above these problems are eliminated by the substitution of TlI by MgI_2 in the present invention. The lamps of the present invention remain at the same CCT and are unchanged in terms of hue remaining white throughout the dimming range.

It is apparent that modifications and changes may be made within the spirit and scope of the present invention, but it is our intention only to be limited by the following claims.

As our invention we claim:

1. A thallium-free ceramic metal halide lamp of different wattage having superior dimming characteristics, said lamp comprising:

a discharge vessel formed of a material resistant to sodium at high temperature;

a thallium-free fill including mercury and metal halides in said vessel including at least one member selected from the group consisting of MgI_2 or $MgBr_2$; and

discharge electrodes positioned at opposite ends within the discharge vessel; and

an envelope surrounding the discharge vessel, the outer jacket is filled with nitrogen.

2. The lamp according to claim 1 wherein said nitrogen is at a pressure between about 350 and 600 mmHg.

3. A lamp as claimed in claim 1 characterized in that the ionizable filling comprises Hg and Ar or Xe, halides of Na and at least one of the elements of Dy, Ho, Tm and wherein the MgI_2 or $MgBr_2$ or both are in a molar quantity between about 5 and 50% of the total molar quantity of the total halides.

4. A lamp as claimed in claim 1 wherein the halides are Na, Dy, Ho and Tm and wherein the total molar quantity of halides of Na, Dy, Ho and Tm is between about 50 and 95%, and wherein such halides are in the form of iodides or bromides.

5. A lamp as claimed in claim 2 in which the molar quantity of Dy halide is between about 0 to 20%.

6. A ceramic metal halide lamp of different wattage having superior dimming characteristics, said lamp comprising:

a discharge vessel formed of a material resistant to sodium at high temperature;

a fill in said vessel including at least one member selected from the group consisting of MgI_2 and/or $MgBr_2$ and an ionizable filling comprising Hg and Ar or Xe, halides of Na and at least one of the halides of Dy, Ho, Tm and wherein the MgI_2 is in a molar quantity between about 5 and 50% of the total molar quantity of the total halides; and

discharge electrodes positioned at opposite ends within the discharge vessel; and

an envelope surrounding the discharge vessel, the outer jacket is filled with nitrogen.

7. A thallium-free ceramic metal halide lamp of different wattage having superior dimming characteristics, said lamp comprising:

a discharge vessel formed of polycrystalline alumina temperature;

an ionizable filling consisting essentially of Hg and Ar or Xe, halides of Na and at least one of the elements of Dy, Tm and Ho plus at least one member selected from the group consisting of MgI_2 and $MgBr_2$ in a molar quantity between about 5 and 50% of the total molar quantity of the total halides in said vessel including MgI_2 and/or $MgBr_2$; and

discharge electrodes positioned at opposite ends within the discharge vessel; and

an envelope surrounding the discharge vessel, the outer jacket is filled with nitrogen.

8. The lamp according to claim 1 wherein said nitrogen is at a pressure between about 350 and 600 mmHg.

ABSTRACT

A thallium free high pressure ceramic metal halide lamp having superior dimming characteristics with a fill composition including MgI_2 and/or $MgBr_2$.

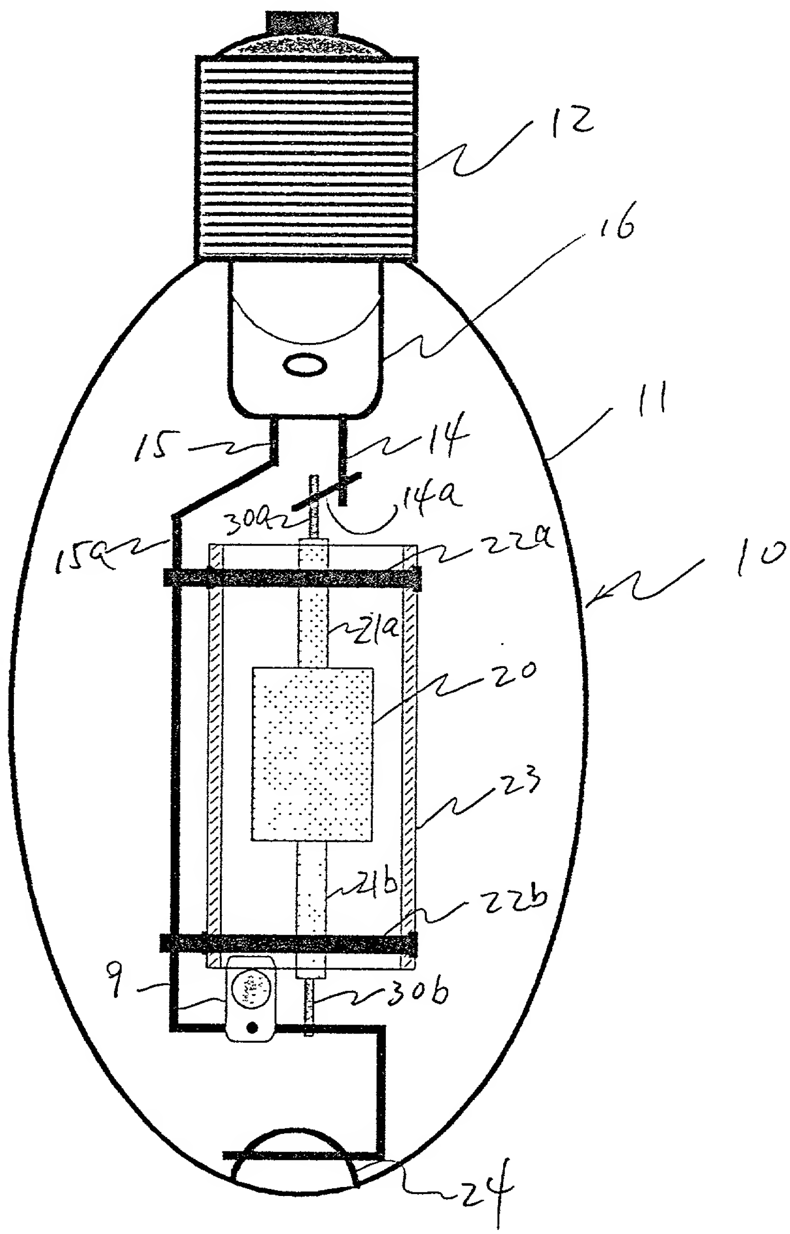


FIG. 1.

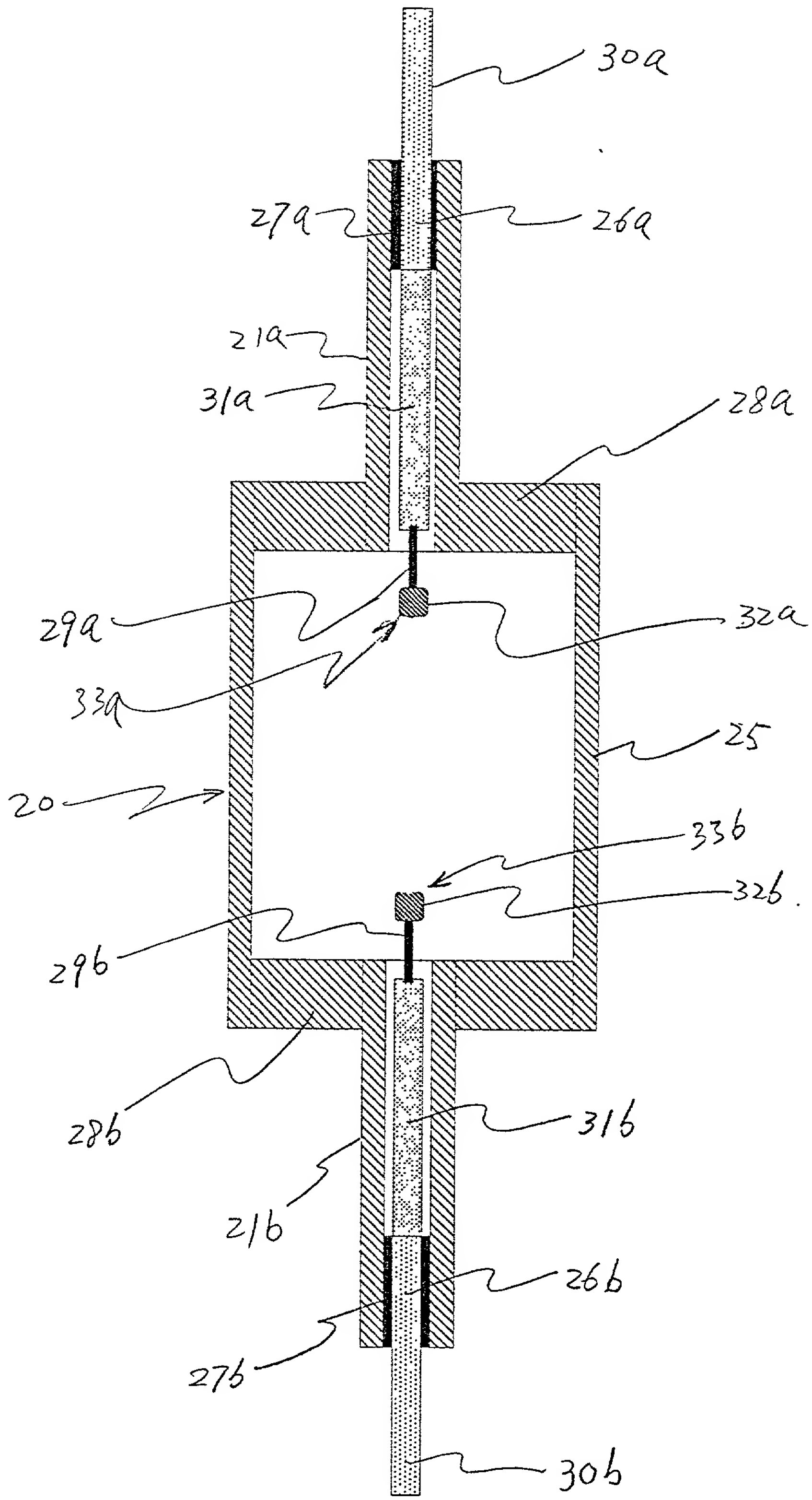

30a
27a
26a
21a
31a
28a
29a
32a
33a
25
20
33b
32b
29b
28b
31b
21b
26b
27b
30b

FIG. 2.

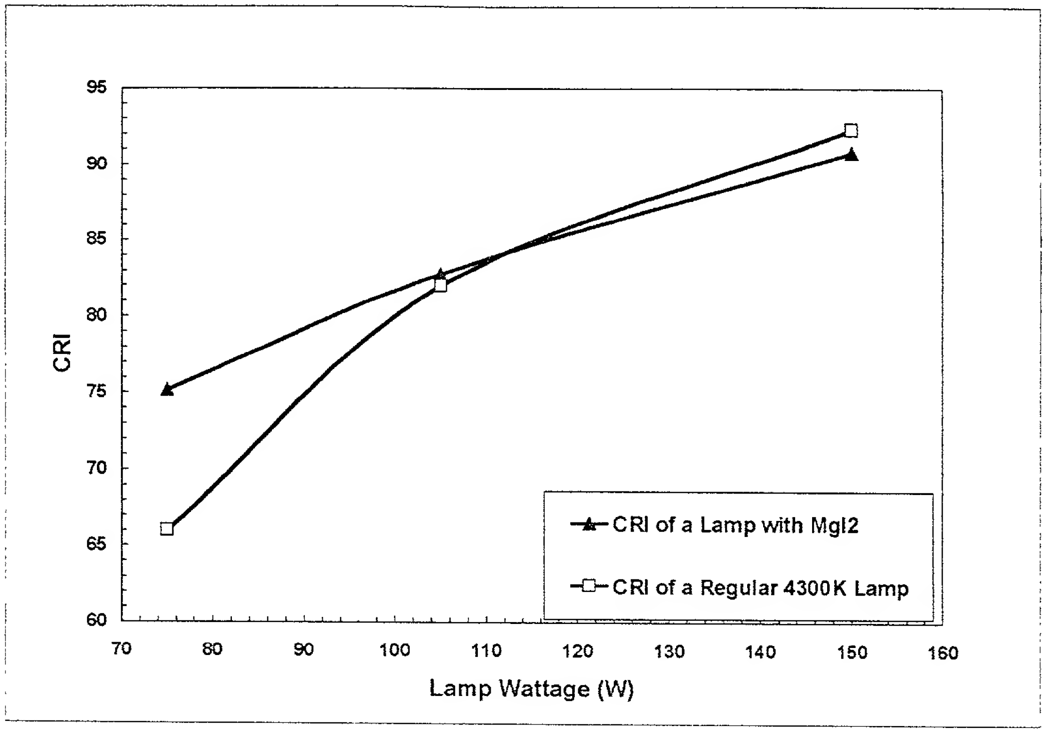

95
90
85
80
75
70
65
60
CRI
70
80
90
100
110
120
130
140
150
160
Lamp Wattage (W)
CRI of a Lamp with MgI2
CRI of a Regular 4300K Lamp

FIG. 3.

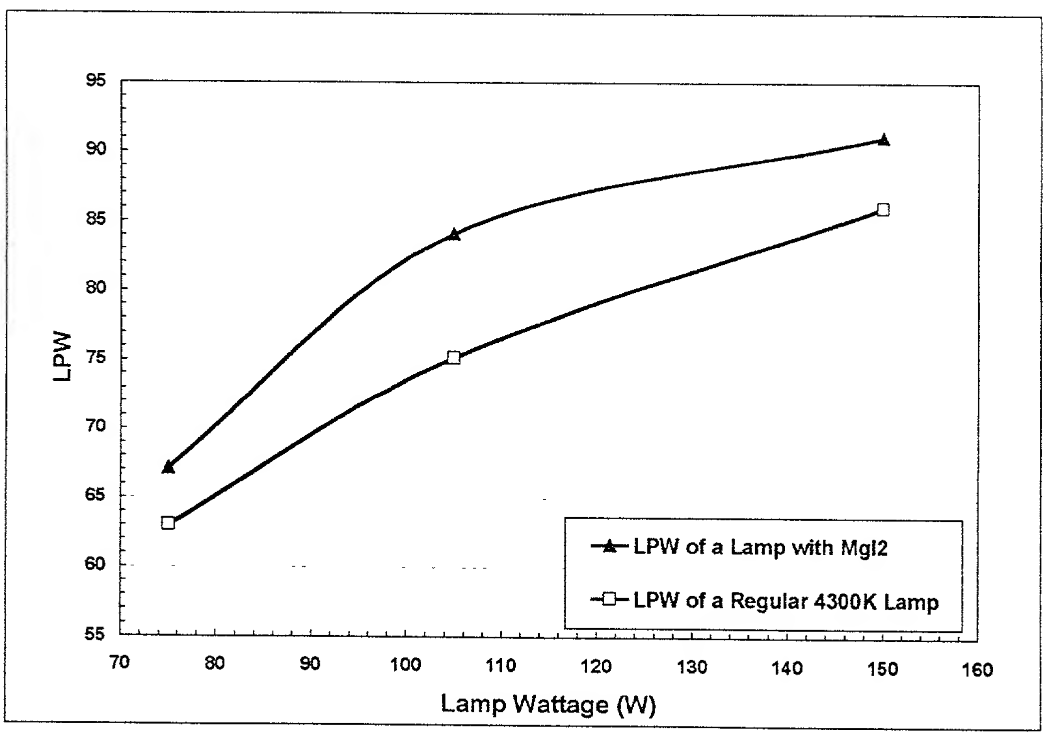
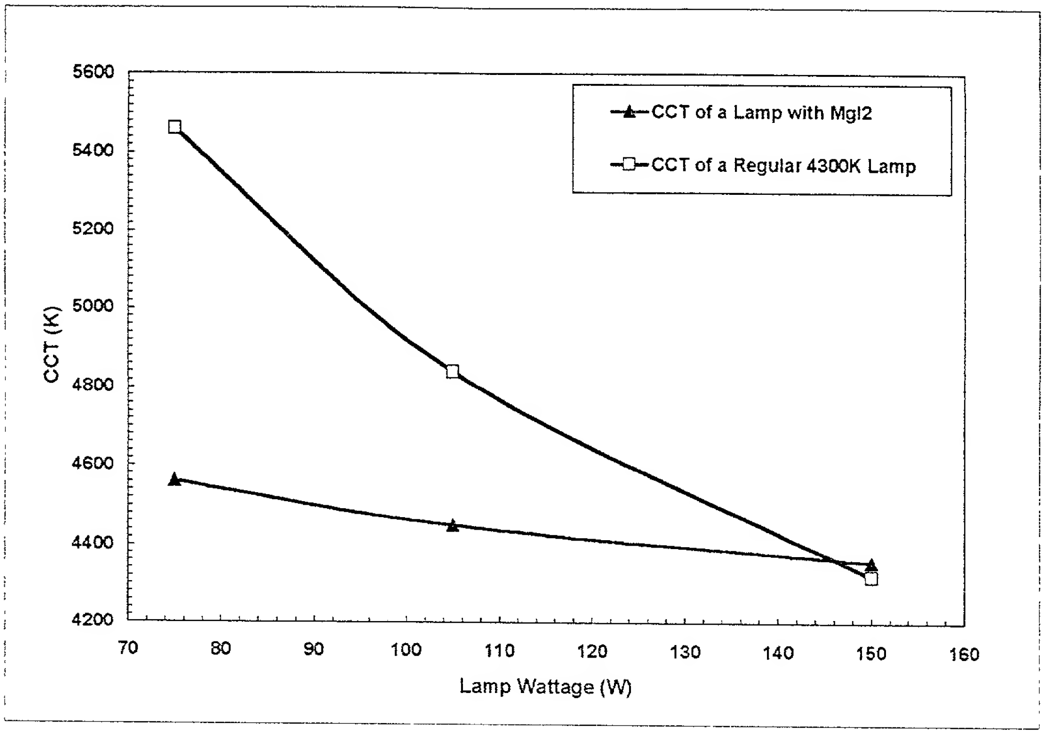
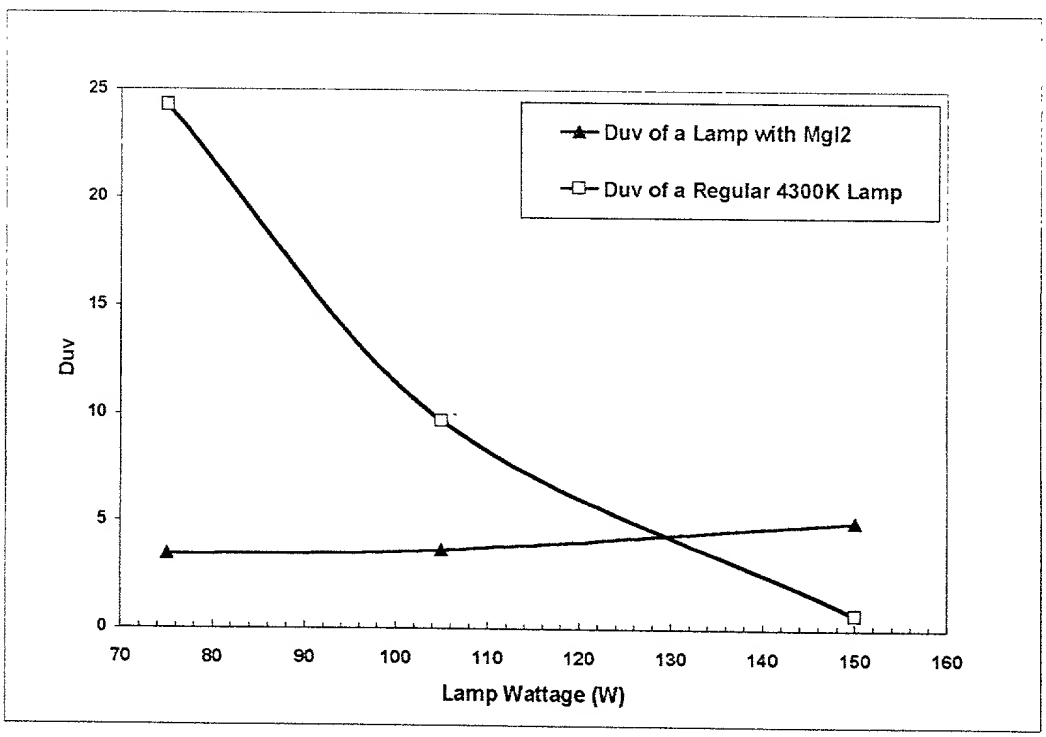

95
90
85
80
75
70
65
60
55
LPW
70
80
90
100
110
120
130
140
150
160
Lamp Wattage (W)
LPW of a Lamp with MgI2
LPW of a Regular 4300K Lamp

FIG.4



CCT of a Lamp with MgI2
CCT of a Regular 4300K Lamp
CCT (K)
5600
5400
5200
5000
4800
4600
4400
4200
70
80
90
100
110
120
130
140
150
160
Lamp Wattage (W)

FIG. 5



Duv of a Lamp with MgI2
Duv of a Regular 4300K Lamp
Duv
25
20
15
10
5
0
70
80
90
100
110
120
130
140
150
160
Lamp Wattage (W)

FIG. 6

Docket No.
MEW1855/055

Declaration and Power of Attorney For Patent Application

English Language Declaration

As a below named inventor, I hereby declare that:

My residence, post office address and citizenship are as stated below next to my name,

I believe I am the original, first and sole inventor (if only one name is listed below) or an original, first and joint inventor (if plural names are listed below) of the subject matter which is claimed and for which a patent is sought on the invention entitled

Thallium Free - Halide Lamp with MgI 2 Filling With Improved Dimming Properties

the specification of which

(check one)

☒ is attached hereto.

☐ was filed on ____________ as United States Application No. or PCT International Application Number ____________ and was amended on ____________ (if applicable)

I hereby state that I have reviewed and understand the contents of the above identified specification, including the claims, as amended by any amendment referred to above.

I acknowledge the duty to disclose to the United States Patent and Trademark Office all information known to me to be material to patentability as defined in Title 37, Code of Federal Regulations, Section 1.56.

I hereby claim foreign priority benefits under Title 35, United States Code, Section 119(a)-(d) or Section 365(b) of any foreign application(s) for patent or inventor's certificate, or Section 365(a) of any PCT International application which designated at least one country other than the United States, listed below and have also identified below, by checking the box, any foreign application for patent or inventor's certificate or PCT International application having a filing date before that of the application on which priority is claimed.

Prior Foreign Application(s)			Priority Not Claimed
(Number)	(Country)	(Day/Month/Year Filed)	☐
(Number)	(Country)	(Day/Month/Year Filed)	☐
(Number)	(Country)	(Day/Month/Year Filed)	☐

I hereby claim the benefit under 35 U.S.C. Section 119(e) of any United States provisional application(s) listed below:

(Application Serial No.)	(Filing Date)
(Application Serial No.)	(Filing Date)
(Application Serial No.)	(Filing Date)

I hereby claim the benefit under 35 U. S. C. Section 120 of any United States application(s), or Section 365(c) of any PCT International application designating the United States, listed below and, insofar as the subject matter of each of the claims of this application is not disclosed in the prior United States or PCT International application in the manner provided by the first paragraph of 35 U.S.C. Section 112, I acknowledge the duty to disclose to the United States Patent and Trademark Office all information known to me to be material to patentability as defined in Title 37, C. F. R., Section 1.56 which became available between the filing date of the prior application and the national or PCT International filing date of this application:

(Application Serial No.)	(Filing Date)	(Status) (patented, pending, abandoned)
(Application Serial No.)	(Filing Date)	(Status) (patented, pending, abandoned)
(Application Serial No.)	(Filing Date)	(Status) (patented, pending, abandoned)

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

POWER OF ATTORNEY: As a named inventor, I hereby appoint the following attorney(s) and/or agent(s) to prosecute this application and transact all business in the Patent and Trademark Office connected therewith. *(list name and registration number)*

Owen J. Meegan, Reg. No., 19,643
Barry D. Josephs, Reg. No., 27,140

Send Correspondence to: **Owen J. Meegan**
24 North Street
Salem, MA 01970

Direct Telephone Calls to: *(name and telephone number)*
Owen J. Meegan (978) 741-4135

Full name of sole or first inventor **Huiling Zhu**	
Sole or first inventor's signature Huiling Zhu	Date July 12, 2000
Residence **101 Kendall Road, Lexington, MA 02421**	
Citizenship **United States**	
Post Office Address **101 Kendall Road, Lexington, MA 02421**	

Full name of second inventor, if any **Jakob Maya**	
Second inventor's signature Jakob Maya	Date July 12, 2000
Residence **25 Marshall Street, Brookline, MA 02446**	
Citizenship **United States**	
Post Office Address **25 Marshall Street, Brookline, MA 02446**	